Report of Subsurface Exploration and Geotechnical Evaluation

Redstone Gateway
Phase 1B
Gravity Sewer
Huntsville, Alabama

Building & Earth Project Number: HV10019

Prepared For:

LBYD Inc.

Prepared By:

BUILDING & EARTH

Geotechnical, Environmental, and Materials Engineers

DATE:

November 19, 2010

BUILDING & EARTH
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November 19, 2010

LBYD Inc
716 South 30th Street
Birmingham, Alabama 35233

Attn: Mr. Rick Nail P.E.

Subject: Report of Subsurface Exploration and
Geotechnical Engineering Evaluation
Redstone Gateway
Phase 1B
Gravity Sewer
Redstone Arsenal, Alabama
Building & Earth Project Number: HV10019

Dear Mr. Nail:

Building & Earth Sciences, Inc. has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed Redstone Gateway Gravity Sewer at Redstone Arsenal in Huntsville, Alabama. Our services were performed in accordance with our proposal 12114R3 dated June 28, 2010.

The purpose of the exploration and evaluation was to help determine the subsurface conditions at the site. A geotechnical evaluation was performed to determine the potential impact of the subsurface conditions on site preparation for the proposed development. The recommendations in this report are based on observation and classification of samples obtained from fifteen (15) soil test borings.

We appreciate the opportunity to provide consultation services for your project. If you have any questions regarding the information in this report or need any additional information, please do not hesitate to contact us.

Respectfully submitted,
BUILDING & EARTH SCIENCES, INC.

ALABAMA LICENSED No. 17102 PROFESSIONAL ENGINEER DONALD D. BROWN

Don Brown, P.E.
Project Manager

Richard Bourquard, P.E.
Senior Geotechnical Engineer

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1.0 PROJECT / SITE DESCRIPTION

This report addresses installation of gravity sewers at the Redstone Gateway project at the Redstone Arsenal in Huntsville, Alabama. (Refer to the Boring Plan for details). The project site is located south of I-565, north of Overlook Road, and west of Rideout Road. According to the project plans dated June 20, 2010, provided by LBYD, Inc., the development will consist of multiple buildings and retail stores. Boulevard A will act as the primary transportation corridor throughout the site.

The site is primarily open pastureland and is presently grass covered. Wooded areas are located to the north near I-565 and near Overlook Road to the south. Currently the site is bisected by an abandoned railroad spur running north to south. To the west of the railroad is a power sub-station and to the east is the Redstone Arsenal Welcome and Visitors Center.

2.0 SCOPE OF SERVICES

The recommendations and findings presented in this report are based upon observation of soil samples obtained within the proposed Redstone EUL sanitary sewer alignment. Fifteen (15) site borings were drilled from October 15 to 19, 2010.

The approximate boring locations are depicted on the Boring Location Plan in the Appendix of this report. The field data and results of the laboratory tests are summarized in this report and include the following:

- Site geology and potential impact on the site development.
- A description of the subsurface conditions encountered at the soil boring locations.
- Presentation of laboratory test results.
- A description of the groundwater conditions observed in the boreholes during drilling. Long-term monitoring was not included in our scope of work.
- Site preparation considerations including suitability of materials at the site for use as structural fill and treatment of unsuitable soils, if encountered.

The scope of services did not include an environmental site assessment or evaluation of potential wetland areas. Any mention of unusual odors or materials on the boring logs or in the report is provided for the client's information only.

3.0 SITE GEOLOGY

According to the Geologic map of Alabama (Special Map 220), the subject is underlain by the Tuscumbia Formation, which is a part of the Interior Low Plateaus physiographic section. The bedrock associated with the Tuscumbia consists of light gray limestone with chert nodules. The rock weathers to a moderately to highly plastic clay with occasional chert.

Since the Tuscumbia is primarily a carbonate rock, it is subject to dissolution along both joints and bedding planes. The dissolution process tends to initially form vertical slots in the limestone. The overlying residual soil can be eroded downward into these vertical slots which subsequently become filled with soft, wet soils. As a result of the physical and chemical weathering process, the bedrock surface is typically highly variable, with relatively hard blocks (or boulders) and pinnacles separated by soil-filled slots. Sinkholes are common in the Tuscumbia Formation due to solution cavities and zones of fracturing associated with the bedrock.

4.0 SUBSURFACE EXPLORATION

The subsurface exploration was performed on October 15 through 19, 2010. All of the site test borings were accessible to the truck-mounted drill rig.

The boring locations were located in the field utilizing GPS coordinates derived from project plans supplied by LBYD Inc. The approximate locations drilled are shown on the Boring Location Plan included in the Appendix of this report.

At each boring location, soil samples were obtained at standard sampling intervals by driving a split-spoon sampler. The borehole was first advanced to the sample depth by auguring, and the sampling tools were placed in the open hole. The sampler was then driven 18 inches into the ground with a 140-pound hammer free falling 30 inches. The number of blows required to drive the sampler each 6 inch increment was recorded. The initial increment is considered the "seating" blows, where the sampler penetrates loose or disturbed soil in the bottom of the borehole. The blows required to penetrate the final two (2) increments were added together and are referred to as the Standard Penetration Test (SPT) N-Value. The N-Value, when properly evaluated, gives an indication of the soil's strength and ability to support structural loads. Many factors can affect the SPT N-Value, so this result cannot be used exclusively to evaluate soil conditions. SPT testing was done in general accordance with ASTM D-1586.

The samples retrieved from the split-spoon sampler were placed in plastic bags, labeled, and transported to our laboratory. The project engineer then visually classified the samples and prepared Boring Logs to summarize the subsurface conditions at each borehole location. The Boring Logs are included in this report. A box within an "x" in the "Sample Type" column of the attached Boring Logs indicates the depths at which the split-spoon samples were obtained. All of the boreholes were backfilled at the completion of field testing.

5.0 LABORATORY ANALYSES

After the soil samples were visually classified, representative samples were selected by the project engineer for laboratory analysis. The laboratory analysis for the investigation included three (3) Atterberg Limits tests and twenty-four (24) natural moisture content determinations.

5.1 DESCRIPTION OF SOILS (VISUAL-MANUAL PROCEDURE) (ASTM D 2488)

The soil samples were visually examined by our engineer and soil descriptions were provided. Representative samples were then selected and tested in accordance with the aforementioned laboratory-testing program to determine soil classifications and engineering properties. This data was used to correlate our visual descriptions with the Unified Soil Classification System (USCS).

5.2 NATURAL MOISTURE CONTENT (ASTM D 2216)

Natural moisture contents (M %) was determined on selected samples. The natural moisture content is the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of solid particles. The results are indicated on the attached Boring Logs.

5.3 ATTERBERG LIMITS (ASTM D-4318)

Atterberg Limits tests were performed to evaluate the soil's plasticity characteristics. The soil Plasticity Index (PI) is representative of this characteristic and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). The Liquid Limit is the moisture content at which the soil will flow as a heavy viscous fluid. The Plastic Limit is the moisture content at which the soil is between "plastic" and the semi-solid stage. The results of these tests are presented on the boring logs in the Appendix. The Plasticity Index (PI = LL - PL) is a frequently used indicator for a soil's potential for volume change. Typically, a soil's potential for volume change increases with higher plasticity indices.

5.4 POCKET PENETROMETER

Pocket Penetrometer (P.P.) tests were performed on cohesive soil samples. The pocket penetrometer provides a consistency classification, and an indication of the soil's unconfined compressive strength. The pocket penetrometer data are presented in the attached Boring Logs.

6.0 GEOTECHNICAL SITE CHARACTERISTICS

The subsurface conditions at the site were evaluated by observing and classifying soil samples obtained from the soil test borings. The conditions between the boreholes are assumed to be similar to the conditions encountered at the borehole locations. The following discussion regarding subsurface conditions and the subsequent recommendations are based on the supposition that no significant changes in subsurface condition occur between boreholes. The presumed conditions should be verified during site preparation and foundation installation.

6.1 SURFACE CONDITIONS

The site is relatively level and was accessible to our truck mounted drilling equipment. Vegetation at the site primarily consisted of pasture grass with few wooded areas. Topsoil, generally less than 6 inches thick, was observed at the boring locations. Note that some localized zones of deeper topsoil may be encountered. Also, the subject area has been cultivated in the past so a deeper zone of roots and organics may be present.

6.2 RESIDUAL SOILS

Residual materials are formed by the in-place weathering of the parent bedrock. Residual soils were encountered below the existing topsoil and continued to termination depth in each boring. The soils encountered within the test locations generally consisted of an upper and lower stratum.

The residual soil in the upper stratum primarily consisted of moderately plastic, yellowish-brown, lean sandy clay (CL/CH). The upper zone was typically between 3 and 5 feet thick. Based on SPT N-values and pocket penetrometer tests, the overall consistency of the residual soil encountered within the upper stratum was classified as very stiff. The lower stratum generally consisted of fat clay (CH). Based on SPT N-values and pocket penetrometer tests, the overall consistency of the residual soil encountered within the lower stratum upper zone was classified as stiff to very stiff. The pipe invert elevations for each test location are depicted on the test logs within the appendix of this report. Within most test locations, the pipe will be bearing on very stiff fat clay.

The results of the laboratory tests performed during this investigation are presented below.

Boring Location	Sample Depth (ft)	LL	PL	PI	Moisture Content (%)	USCS
SS-1	3.5-5.0	51	27	24	24.3	CH
SS-1	6.0-7.5	-	-	-	27	-
SS-2	3.5-5.0	-	-	-	27	-
SS-2	8.5-10.0	-	-	-	27.3	-
SS-3	3.5-5.0	-	-	-	24.2	-
SS-3	13.5-15.0	-	-	-	28.4	-
SS-4	3.5-5.0	-	-	-	25.2	-
SS-4	8.5-10.0	-	-	-	29.7	-
SS-5	6.0-7.5	-	-	-	23.3	-
SS-5	8.5-10.0	-	-	-	26.3	-
SS-6	3.5-5.0	-	-	-	25.1	-
SS-6	8.5-10.0	-	-	-	30.7	-
SS-7	1.0-2.5	-	-	-	24.3	-
SS-7	3.5-5.0	57	25	32	31.4	CH
SS-8	6.0-7.5	-	-	-	25.8	-
SS-8	8.5-10.0	-	-	-	37.5	-
SS-9	3.5-5.0	-	-	-	28.3	-
SS-9	8.5-10.0	-	-	-	25.9	-
SS-10	6.0-7.5	-	-	-	16.3	-
SS-10	8.5-10.0	64	28	36	34.6	CH
SS-11	3.5-5.0	-	-	-	21.9	-
SS-11	8.5-10.0	-	-	-	34.1	-
SS-12	3.5-5.0	-	-	-	20.3	-
SS-12	6.0-7.5	-	-	-	22.9	-

6.3 GROUNDWATER IN THE BOREHOLES

Groundwater was not encountered in the borings at the time of drilling. The borings were backfilled at completion of excavation. Please note that short-term water level readings are not necessarily an accurate indication of the actual groundwater level. The presence or absence of water in boreholes can be affected by the prevalent weather conditions prior to and during the field exploration.

6.4 AUGER REFUSAL

Auger refusal is the drilling depth at which the borehole can no longer be advanced using the current drilling procedure. None of the borings within this exploration reached refusal.

6.5 TEMPORARY EXCAVATIONS

For pipe excavations Occupational Safety & Health Administration (OSHA 29 CFR Part 1926 Subpart P) guidelines should be utilized. Within the test locations of this report pipe invert depths should be referenced to determine soil types and conditions expected to be encountered.

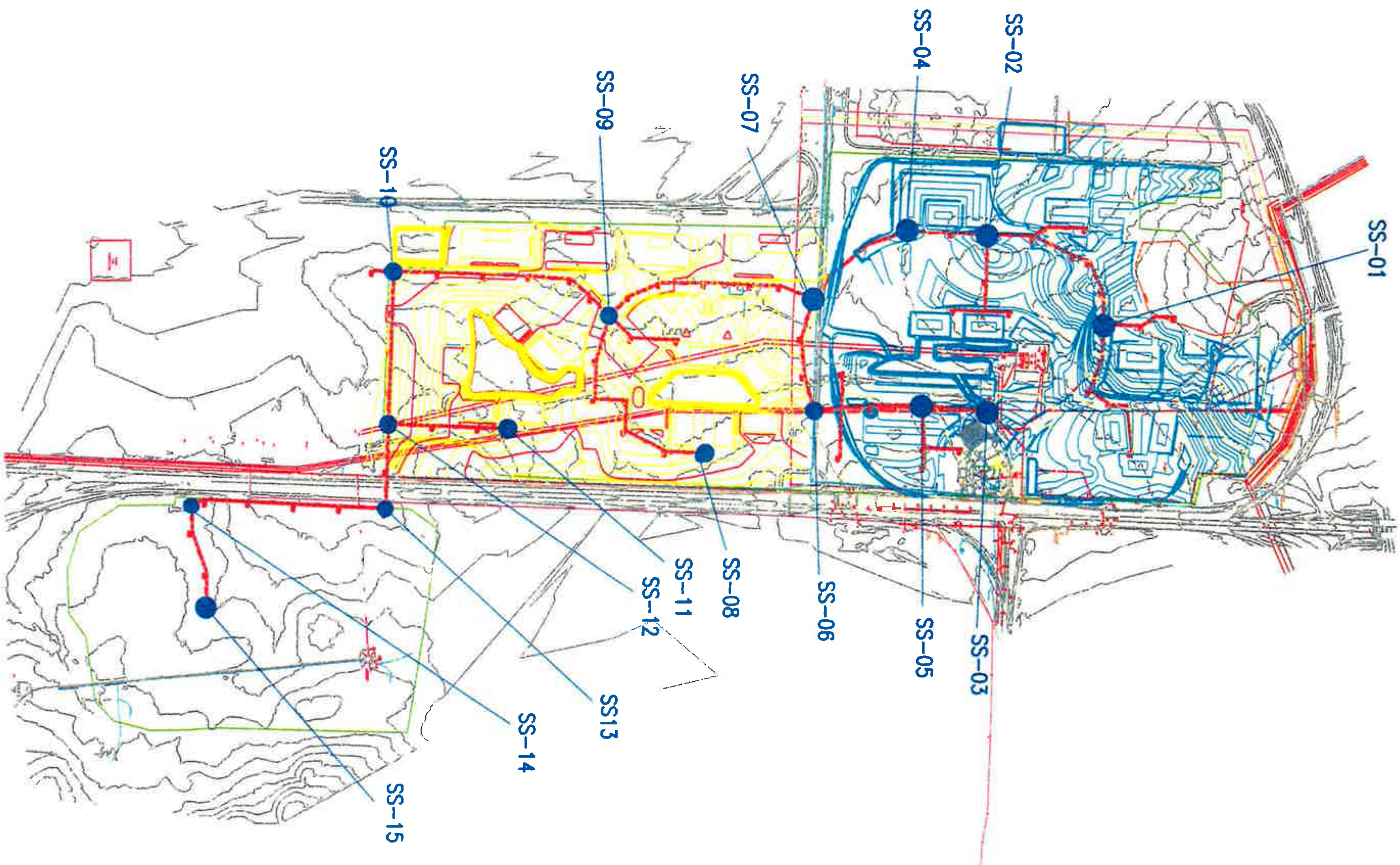
7.0 CONSTRUCTION MONITORING

The recommendations presented in this report are based on information obtained from fifteen (15) soil test borings. Field verification of site conditions is an essential part of the services provided by the geotechnical consultant. To confirm the recommendations included herein, a geotechnical engineer should make periodic visits to the site during site during pipe trench excavation.

8.0 CLOSING

This report was prepared for the exclusive use of LBYD, Inc. for specific application to the subject site at the Redstone Arsenal in Huntsville, Alabama. The information in this report is not transferable. This report should not be used for a different development on the same property without first being evaluated by the engineer. The recommendations in this report were based on the information obtained from the field exploration, laboratory analysis, and engineering judgment regarding conditions between borings. The anticipated subsurface conditions should be confirmed during site grading and foundation installation.

This report is intended for use during design and preparation of specifications, and it may not address all conditions at the site at the time of construction. Contractors reviewing this information should acknowledge that this document is for design information only.



REFERENCE USED TO PRODUCE THIS DRAWING:	BORING LOCATION PLAN		DATE: 29 November 2010	BUILDING & EARTH Geotechnical, Environmental, and Materials Engineers
LBYD DRAWING	PROJECT NO: HV 10019	PROJECT NAME / LOCATION: Redstone Gateway Gravity Sewer Boring Locations	SCALE: NTS'	

BORING LOG DESCRIPTION

Building & Earth Sciences, Inc. uses the gINT software program to prepare the attached boring logs. The gINT program provides the flexibility to custom design the boring logs to include the pertinent information from the subsurface exploration and results of our laboratory analysis. The soil and laboratory information included on our logs is summarized below:

Depth
The depth below the ground surface is shown.

Sample Type
The method used to collect the sample is shown. The typical sampling methods include Split Spoon Sampling, Shelby Tube Sampling, Grab Samples, and Rock Core. A key is provided at the bottom of the log showing the graphic symbol for each sample type.

Sample Number
Each sample collected is numbered sequentially

Blows per 6", REC%, RQD%
When Standard Split Spoon sampling is used, the blows required to drive the sampler each 6-inch increment are recorded and shown in column 4. When rock core is obtained the recovery ration (REC%) and Rock Quality Designation (RQD%) is recorded.

Soil Data
Column 5 is a graphic representation of 4 different soil parameters. Each of the parameters use the same graph, however, the values of the graph subdivisions vary with each parameter. Each parameter presented on column 5 is summarized below:

- **N-Value**- The Standard Penetration Test N-Value, obtained by adding number of blows required to drive the sampler the final 12 inches, is recorded. The graph labels range from 0 to 50.
- **Qu** – Unconfined Compressive Strength estimate from the Pocket Penetrometer test in tons per square foot (tsf). The graph labels range from 0 to 5 tsf.
- **Atterberg Limits** – The Atterberg Limits are plotted with the plastic limit to the left, and liquid limit to the right, connected by a horizontal line. The difference in the plastic and liquid limits is referred to as the Plasticity Index. The Atterberg Limits test results are also included in the Notes column on the far right column of the boring log. The Atterberg Limits graph labels range from 0 to 100.
- **% Moisture** – The Natural Moisture Content of the soil sample as determined in our laboratory.

Soil Description
The soil description prepared in accordance with ASTM D 2488, Visual Description of Soil Samples. The Munsel Color chart is used to determine the soil color. Strata changes are indicated by a solid line, with the depth of the change indicated on the left side of the line. If subtle changes within a soil type occur, a broken line is used. The Boring Termination or Auger Refusal depth is shown as a solid line at the bottom of the boring.

Graphic
The graphic representation of the soil type is shown. The graphic used for each soil type is related to the Unified Soil Classification chart. A chart showing the graphic associated with each soil classification is included.

Remarks
Remarks regarding borehole observations, and additional information regarding the laboratory results and groundwater observations.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BUILDING & EARTH SCIENCES, INC.

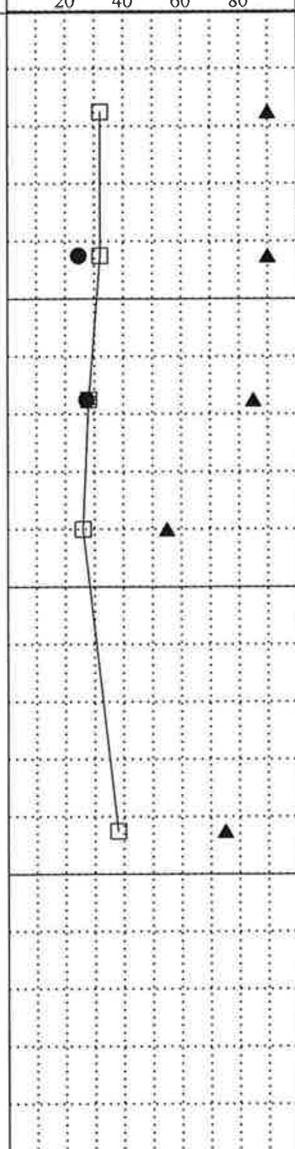
5545 Derby Drive, Birmingham, AL 35210 (205) 836-6300

LOG OF BORING: SS-01

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 24A

Project Location: Huntsville, AL
Date Drilled: 10/15/10
Surface Elevation: 658

□ N-Value □ 10 20 30 40
▲ Qu (tsf) ▲ 1 2 3 4
I Atterberg Limits I 20 40 60 80
● % Moisture ● 20 40 60 80



DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	GRAPHIC	REMARKS
		Split Spoon	1	4-8-8	SANDY LEAN CLAY (CL): very stiff, dark yellowish-brown, with traces of root fibers, dry		
3.5	654.5						
	655	Split Spoon	2	7-8-8	LEAN TO FAT CLAY (CH): very stiff, reddish-brown, with traces of sand size black nodules, dry		Sample #2 Liquid Limit (LL) = 51 Plastic Limit (PL) = 27 Plasticity Index (PI) = 24
5		Split Spoon	3	6-6-8	stiff		
	650	Split Spoon	4	5-6-7	with traces of sand size chert fragments, slightly moist		
10							
13.0	645.0				(RESIDUAL)		
	645	Split Spoon	5	10-9-10	FAT CLAY (CH): very stiff, yellowish-brown, with sand and gravel size chert fragments, wet		
15.0	643.0						
15					Boring Terminated at 15 feet		
	640						No groundwater encountered at time of drilling Backfilled 10/15/10

SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
▽ GROUNDWATER LEVEL IN THE BOREHOLE
Qu UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST
REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED

Birmingham 5545 Derby Dr Birmingham, AL 35210
Columbus 5045 Milgen Ct Unit 2 Columbus, GA 31907
Tulsa 10828 E. Newton St #111 Tulsa, OK 74116
Atlanta 4124 Daniel Green Trail Smyrna, GA 30080
Savannah 3911 Old Louisville Rd #107 Garden City, GA 31408

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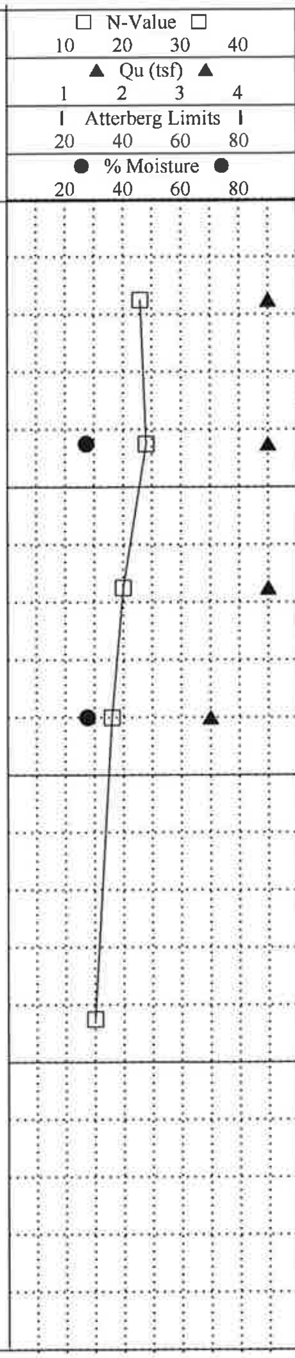
5545 Derby Drive, Birmingham, AL 35210 (205) 836-6300

LOG OF BORING: SS-02

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 19A

Project Location: Huntsville, AL
Date Drilled: 10/15/10
Surface Elevation: 644

Sample No.	Sample Type	Blows per Increment	Elevation (ft)
1	Split Spoon	5-10-13	
2	Split Spoon	7-11-13	640
3	Split Spoon	6-9-11	
4	Split Spoon	4-7-11	635
5	Split Spoon	6-7-8	630



Depth (ft)	Elevation	SOIL DESCRIPTION	REMARKS
0.0–3.5	644–640.5	SANDY LEAN CLAY (CL): very stiff, brown, with traces of root fibers, dry	
3.5–8.0	640.5–636.0	LEAN TO FAT CLAY (CL-CH): very stiff, reddish-brown, with traces of sand size black nodules, dry with traces of chert fragments (RESIDUAL)	
8.0–15.0	636.0–629.0	FAT CLAY (CH): very stiff, reddish-brown, with traces of sand and gravel size chert fragments, slightly moist	
15.0–17.0	629.0–627.0	Boring Terminated at 15 feet	
			No groundwater encountered at time of drilling Backfilled 10/15/10

SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
∇	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

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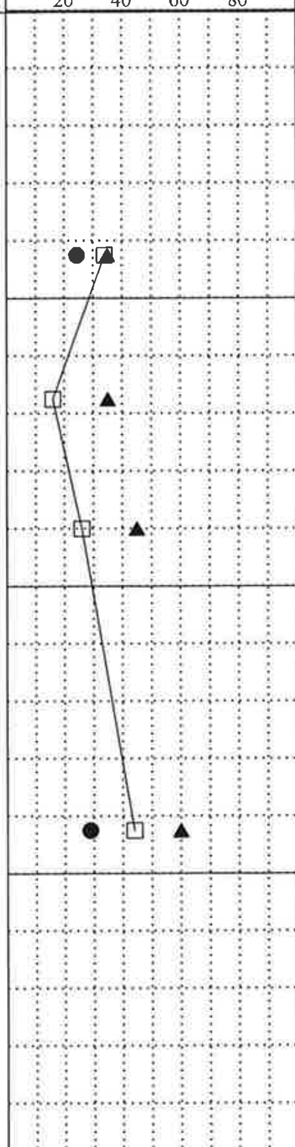
5545 Derby Drive, Birmingham, AL 35210 (205) 836-6300

LOG OF BORING: SS-03

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 8B
Project Location: Huntsville, AL
Date Drilled: 10/15/10
Surface Elevation: 636

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	REMARKS
0.0–3.0	636–633.0				No Retrieval - 1 foot of stone	
3.0–5.0	633.0–631.0	Split Spoon	1	6-8-9	LEAN CLAY (CL): very stiff, dark brown, moist (POSSIBLE TOPSOIL)	
5.0–13.0	631.0–623.0	Split Spoon	2	2-4-4	LEAN CLAY (CL): stiff, brown, with traces of black, moist	
		Split Spoon	3	4-6-7	dark brown to yellowish-brown	
13.0–15.0	623.0–621.0	Split Spoon	4	8-10-12	FAT CLAY (CH): very stiff, light yellowish-brown, with few sand and gravel size chert fragments, moist (RESIDUAL)	
15.0	621.0				Boring Terminated at 15 feet	No groundwater encountered at time of drilling Backfilled 10/15/10

☐ N-Value ☐ 10 20 30 40
▲ Qu (tsf) ▲ 1 2 3 4
I Atterberg Limits I 20 40 60 80
● % Moisture ● 20 40 60 80



SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
▽	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

Birmingham
5545 Derby Dr
Birmingham, AL 35210

Columbus
5045 Milgen Ct Unit 2
Columbus, GA 31907

Tulsa
10828 E. Newton St #111
Tulsa, OK 74116

Atlanta
4124 Daniel Green Trail
Smyrna, GA 30080

Savannah
3911 Old Louisville Rd #107
Garden City, GA 31408

BUILDING & EARTH SCIENCES, INC.

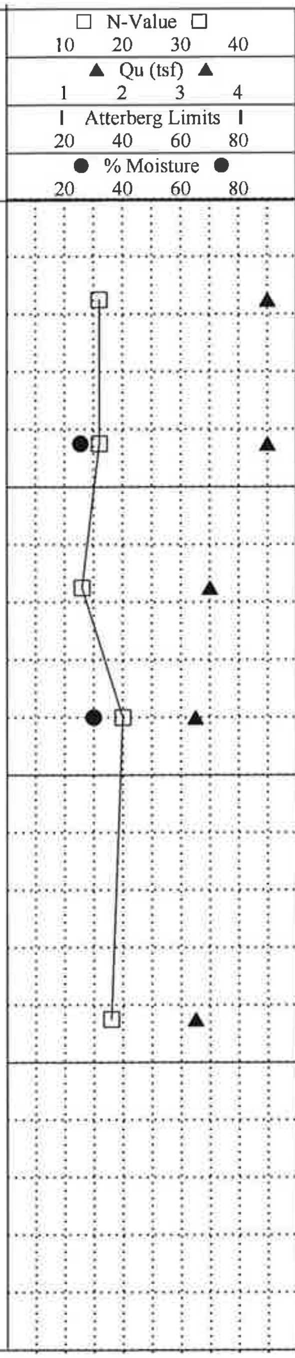
5545 Derby Drive, Birmingham, AL 35210 (205) 836-6300

LOG OF BORING: SS-04

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 17A

Project Location: Huntsville, AL
Date Drilled: 10/15/10
Surface Elevation: 642

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	REMARKS
	640	Split Spoon	1	5-7-9	SANDY LEAN CLAY (CL): very stiff, brown, dry	
3.0	639.0					
		Split Spoon	2	5-7-9	LEAN TO FAT CLAY (CL-CH): very stiff, reddish-brown, dry (RESIDUAL)	
5.0	637.0					
	635	Split Spoon	3	6-6-7	FAT CLAY (CH): stiff, reddish-brown, slightly moist	
		Split Spoon	4	6-10-10	with traces of sand and gravel size chert fragments	
10	630					
		Split Spoon	5	6-9-9	wtih sand and gravel size chert fragments	
15.0	627.0					
	625				Boring Terminated at 15 feet	No groundwater encountered at time of drilling Backfilled 10/15/10



SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
∇ GROUNDWATER LEVEL IN THE BOREHOLE
Qu UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST
REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED

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LOG OF BORING: SS-05

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 6B

Project Location: Huntsville, AL
Date Drilled: 10/18/10
Surface Elevation: 641

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	REMARKS
0.0–3.5	641–637.5				No Retrieval - approximately 1.5 feet of rock	
3.5–5.0	637.5–636.0	Split Spoon	1	6-4-3	LEAN TO FAT CLAY (CL-CH): firm, reddish-brown, slightly moist (RESIDUAL)	
5.0–15.0	636.0–626.0	Split Spoon	2	4-3-4	FAT CLAY (CH): firm, reddish-brown, with traces of sand size chert fragments, slightly moist	
		Split Spoon	3	4-5-6	stiff, light yellowish to reddish-brown, moist	
		Split Spoon	4	7-8-8	yellowish to reddish-brown and gray, with traces of sand and gravel size chert fragments	
15.0	626.0				Boring Terminated at 15 feet	No groundwater encountered at time of drilling Backfilled 10/15/10

Graph headers: N-Value (10, 20, 30, 40); Qu (tsf) (1, 2, 3, 4); Atterberg Limits (20, 40, 60, 80); % Moisture (20, 40, 60, 80)

SAMPLE TYPE: Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
▽	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

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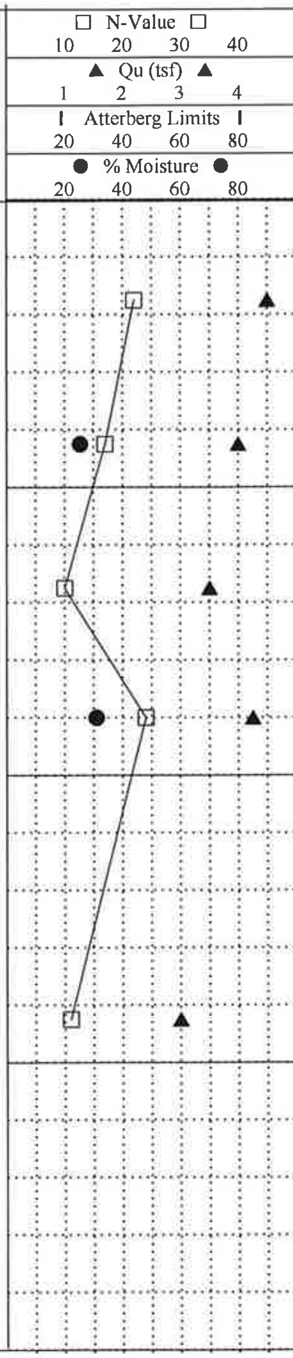
LOG OF BORING: SS-06

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 3B

Project Location: Huntsville, AL
Date Drilled: 10/18/10
Surface Elevation: 645

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	REMARKS
0	645					
		Split Spoon	1	12-10-12	SANDY CLAY (CL): very stiff, reddish-brown, with traces of root fibers, dry	
3.0	642.0					
		Split Spoon	2	6-9-8	LEAN TO FAT CLAY (CL-CH): very stiff, reddish-brown, slightly moist	
5	640					
		Split Spoon	3	5-5-5		
8.0	637.0				(RESIDUAL)	
		Split Spoon	4	8-12-12	FAT CLAY (CH): very stiff, dark yellowish to reddish-brown, with traces of sand and gravel size chert fragments, slightly moist	
10	635					
		Split Spoon	5	3-6-5	stiff, light yellowish to reddish-brown and gray, moist	
15.0	630.0				Boring Terminated at 15 feet	No groundwater encountered at time of drilling Backfilled 10/15/10
	625					



SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
∇ GROUNDWATER LEVEL IN THE BOREHOLE
Qu UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST
REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED

LOG OF BORING 2 REDSTONE GATEWAY - LBYD SANITARY SEWER.GPJ BESI.GDT 12/1/10

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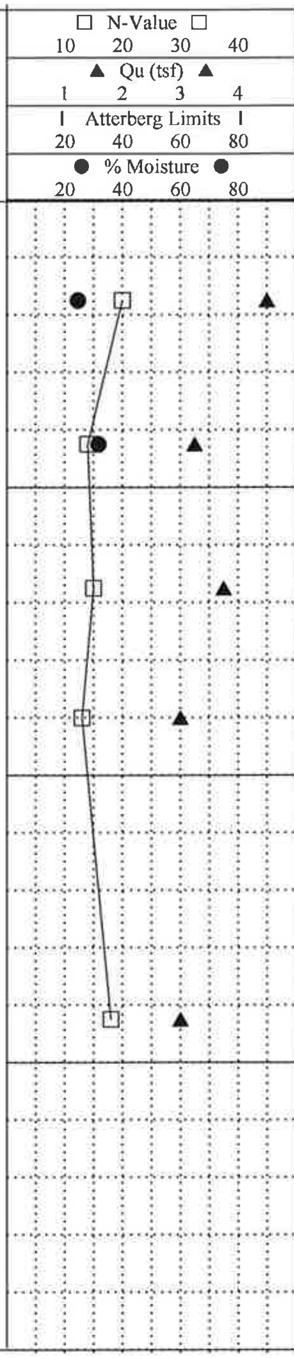
LOG OF BORING: SS-07

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 14A

Project Location: Huntsville, AL
Date Drilled: 10/15/10
Surface Elevation: 634

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	REMARKS
		Split Spoon	1	9-10-10	SANDY LEAN CLAY (CL): very stiff, reddish-brown, dry	
3.0	631.0					
	630	Split Spoon	2	5-7-7	FAT CLAY (CH): stiff, dark yellowish-brown, slightly moist	Sample #2 Liquid Limit (LL) = 57 Plstic Limit (PL) = 25 Plasticity Index (PI) = 32
5						
		Split Spoon	3	5-6-9	very stiff, yellowish to reddish-brown, with traces of sand size chert fragments	
	625	Split Spoon	4	5-6-7	stiff, light yellowish to reddish-brown	
10						
	620	Split Spoon	5	5-7-11	very stiff (RESIDUAL)	
15.0	619.0					
					Boring Terminate at 15 feet	
	615					No groundwater encountered at time of drilling Backfilled 10/15/10



SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
∇	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

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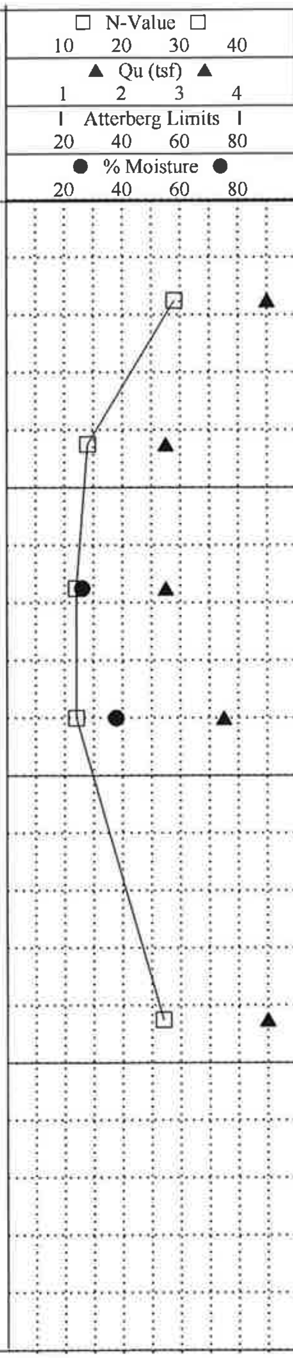
LOG OF BORING: SS-08

Sheet 1 of 1

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 6K

Project Location: Huntsville, AL
Date Drilled: 10/19/10
Surface Elevation: 642



DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	GRAPHIC	REMARKS
	640	Split Spoon	1	11-13-16	SANDY LEAN CLAY (CL): very stiff, reddish-brown, with traces of root fibers, dry		
3.0	639.0						
5		Split Spoon	2	5-7-7	LEAN TO FAT CLAY (CL-CH): stiff, reddish-brown, slightly moist		
	635	Split Spoon	3	4-6-6	very stiff		
8.0	634.0				(RESIDUAL)		
10		Split Spoon	4	7-7-5	FAT CLAY (CH): stiff, reddish-brown, with traces of sand size chert fragments, slightly moist		
	630						
15		Split Spoon	5	7-15-12	very stiff, light yellowish to reddish-brown, with traces of sand and gravel size chert fragments, moist		
15.0	627.0						
	625				Boring Terminated at 15 feet		No groundwater encountered at time of drilling Backfilled 10/15/10

SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
▽	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

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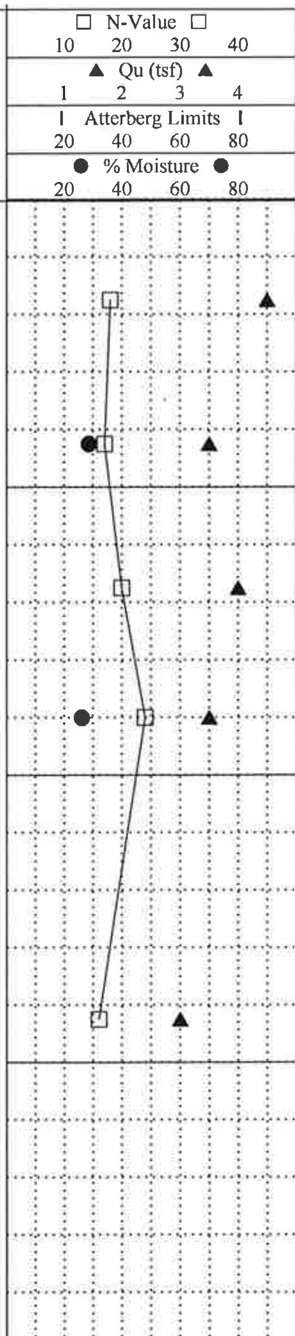
LOG OF BORING: SS-09

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 8A

Project Location: Huntsville, AL
Date Drilled: 10/19/10
Surface Elevation: 627

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	REMARKS
	625	Split Spoon	1	9-10-8	SANDY LEAN CLAY (CL): very stiff, brown, with traces of root fibers, dry	
3.0	624.0					
		Split Spoon	2	7-7-10	LEAN TO FAT CLAY (CL-CH): very stiff, dark yellowish-brown, with traces of sand size chert fragments, slightly moist	
5						
	620	Split Spoon	3	9-9-11	very stiff, yellowish-to reddish-brown	
		Split Spoon	4	8-10-14	no chert fragments	
10						
	615					
13.0	614.0				(RESIDUAL)	
		Split Spoon	5	4-7-9	FAT CLAY (CH): very stiff, dark yellowish-brown, with few sand and gravel size chert fragments, slightly moist	
15.0	612.0					
	610				Boring Terminated at 15 feet	No groundwater encountered at time of drilling Backfilled 10/15/10



SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
∇	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

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LOG OF BORING: SS-10

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 2A
Project Location: Huntsville, AL
Date Drilled: 10/18/10
Surface Elevation: 624

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	GRAPHIC	REMARKS
0.0–3.0	624.0–621.0	Split Spoon	1	9-10-11	SANDY LEAN CLAY (CL): very stiff, reddish-brown, dry		
3.0–8.0	621.0–616.0	Split Spoon	2	7-10-11	LEAN TO FAT CLAY (CL-CH): very stiff, yellowish and reddish-brown, slightly moist		
		Split Spoon	3	7-9-12	(RESIDUAL)		
8.0–15.0	616.0–609.0	Split Spoon	4	7-12-10	FAT CLAY (CH): very stiff, light yellowish-brown, with few sand and gravel size rock fragments, slightly moist		Sample #4 Liquid Limit (LL0 = 64 Plastic Limit (PL) = 28 Plasticity Index (PI) = 36
		Split Spoon	5	10-9-13	light yellowish to reddish-brown		
15.0	609.0				Boring Terminated at 15 feet		No groundwater encountered at time of drilling Backfilled 10/15/10

Chart scales: □ N-Value □ 10 20 30 40; ▲ Qu (tsf) ▲ 1 2 3 4; I Atterberg Limits I 20 40 60 80; ● % Moisture ● 20 40 60 80

SAMPLE TYPE ☒ Split Spoon

N-VALUE STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE PERCENT NATURAL MOISTURE CONTENT
▽ GROUNDWATER LEVEL IN THE BOREHOLE
Qu UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST
REC RECOVERY
RQD ROCK QUALITY DESIGNATION
UD UNDISTURBED

LOG OF BORING 2 REDSTONE GATEWAY - LBYD SANITARY SEWER.GPJ BESI.GDT 12/1/10

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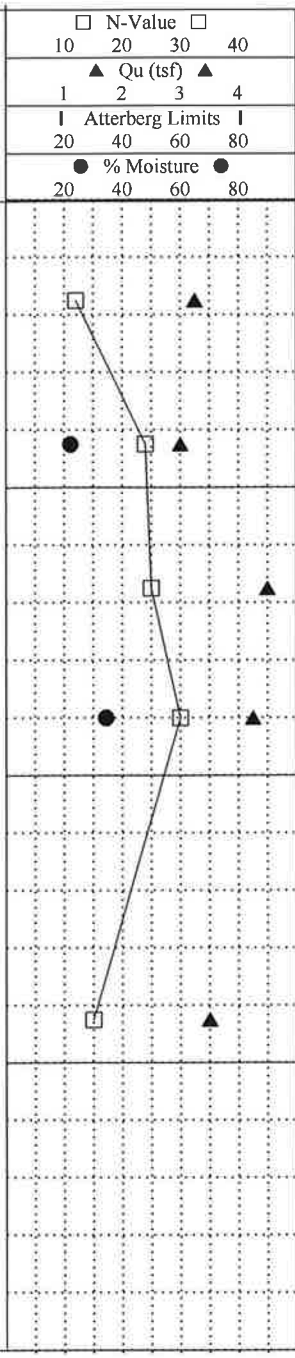
LOG OF BORING: SS-11

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 3M

Project Location: Huntsville, AL
Date Drilled: 10/18/10
Surface Elevation: 632



DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	GRAPHIC	REMARKS
	630	Split Spoon	1	5-5-7	LEAN CLAY (CL): stiff, reddish-brown, with black nodules, slightly moist		
5		Split Spoon	2	7-11-13	very stiff		
	625	Split Spoon	3	8-11-14			
8.0	624.0				(RESIDUAL)		
10		Split Spoon	4	7-11-19	FAT CLAY (CH): very stiff, dark yellowish-brown, with sand and gravel size chert fragments, slightly moist		
	620	Split Spoon	5	6-7-8	yellowish to reddish-brown		
15.0	617.0						
15	615				Boring Terminated at 15 feet		No groundwater encountered at time of drilling Backfilled 10/15/10

SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
∇	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

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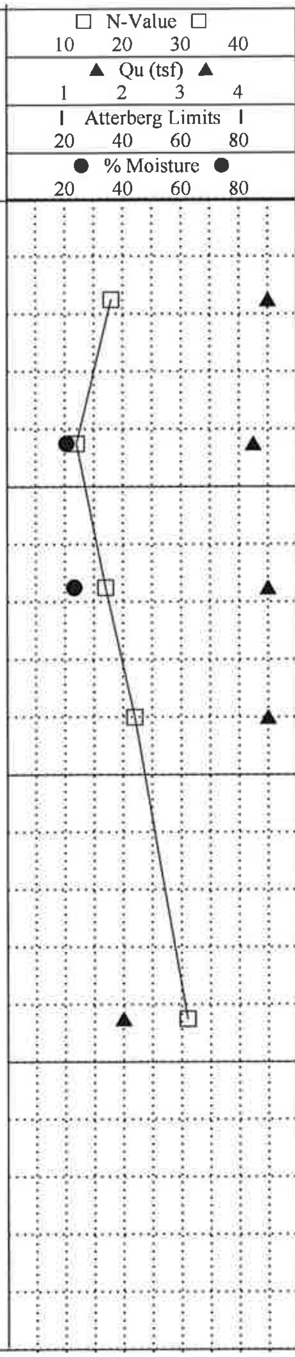
LOG OF BORING: SS-12

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 4L

Project Location: Huntsville, AL
Date Drilled: 10/18/10
Surface Elevation: 624



DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	GRAPHIC	REMARKS
		Split Spoon	1	10-10-8	SANDY LEAN CLAY (CL): very stiff, dark yellowish-brown, dry		
3.0	621.0						
	620	Split Spoon	2	5-5-7	LEAN TO FAT CLAY (CL-CH): stiff, dark yellowish-brown, slightly moist		
5							
		Split Spoon	3	5-7-10	very stiff, yellowish-brown, with few sand and gravel size chert fragments, (RESIDUAL)		
8.0	616.0						
	615	Split Spoon	4	6-10-12	FAT CLAY (CH): very stiff, yellowish to reddish-brown, with traces of sand and gravel size chert fragments, slightly moist		
10							
	610	Split Spoon	5	10-14-17	hard, with sand and gravel size chert fragments		
15.0	609.0						
15					Boring Terminated at 15 feet		
	605						No groundwater encountered at time of drilling Backfilled 10/15/10

SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
▽	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

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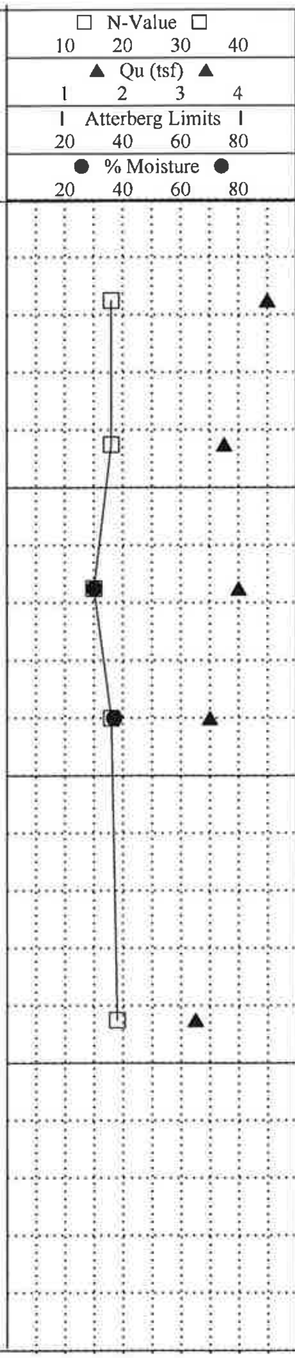
LOG OF BORING: SS-13

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 6L

Project Location: Huntsville, AL
Date Drilled: 10/18/10
Surface Elevation: 629

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	REMARKS
		Split Spoon	1	8-9-9	SANDY LEAN CLAY (CL): very stiff, brown, dry	
3.0	626.0					
	625	Split Spoon	2	8-8-10	LEAN TO FAT CLAY (CL-CH): very stiff, yellowish-brown, with traces of sand size chert fragments and black nodules, slightly moist (RESIDUAL)	
5						
6.0	623.0					
		Split Spoon	3	7-7-8	FAT CLAY (CH): very stiff, light yellowish to reddish-brown, slightly moist	
	620	Split Spoon	4	5-8-10	with traces of sand size chert fragments	
10						
	615	Split Spoon	5	6-9-10	light yellowish-brown to reddish-brown and gray, moist	
15.0	614.0					
					Boring Terminated at 15 feet	
	610					No groundwater encountered at time of drilling Backfilled 10/15/10



SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
∇	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

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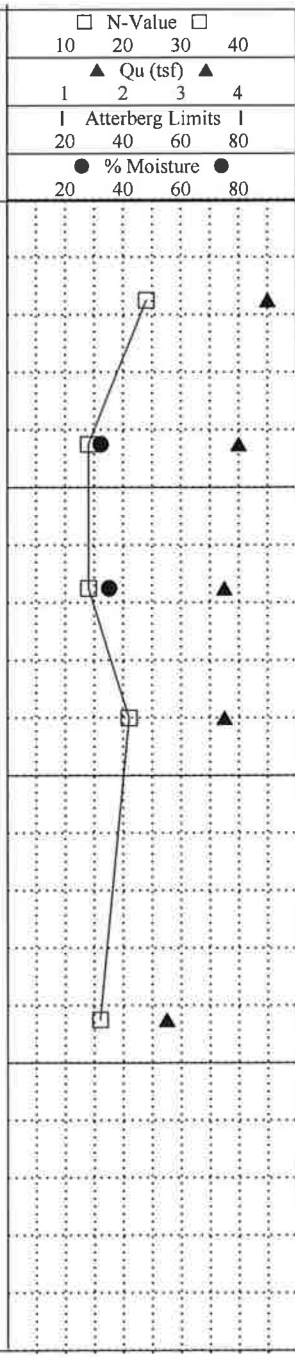
LOG OF BORING: SS-14

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH# 11L
Project Location: Huntsville, AL
Date Drilled: 10/18/10
Surface Elevation: 629

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	REMARKS
		Split Spoon	1	13-12-12	SANDY LEAN CLAY (CL): very stiff, reddish-brown, dry	
3.0	626.0					
	625	Split Spoon	2	6-7-7	FAT CLAY (CH): stiff, reddish-brown, with traces of sand and gravel size chert fragments, slightly moist	
5						
		Split Spoon	3	6-7-7		
	620	Split Spoon	4	6-9-12	very stiff, yellowish to reddish-brown	
10						
	615	Split Spoon	5	8-8-8	(RESIDUAL)	
15.0	614.0					
15					Boring Terminated at 15 feet	
	610					No groundwater encountered at time of drilling Backfilled 10/15/10



SAMPLE TYPE ☒ Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT
∇	GROUNDWATER LEVEL IN THE BOREHOLE
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST
REC	RECOVERY
RQD	ROCK QUALITY DESIGNATION
UD	UNDISTURBED

LOG OF BORING 2 REDSTONE GATEWAY - LBYD SANITARY SEWER.GPJ BESI.GDT 12/1/10

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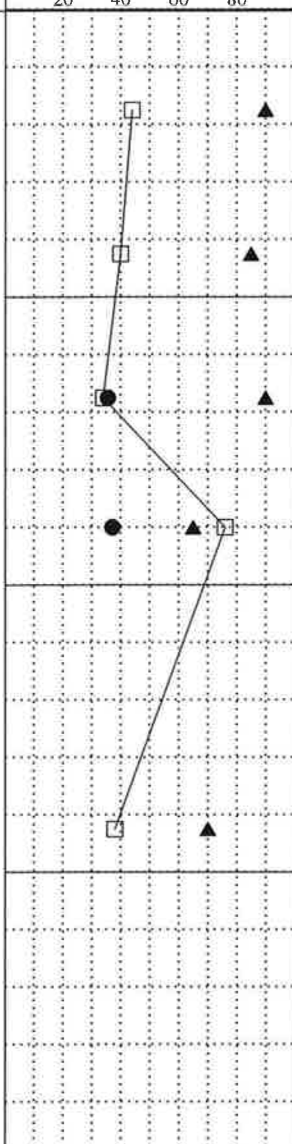
LOG OF BORING: SS-15

Project Name: Redstone Gateway - LBYD Sanitary Sewer
Project Number: HV10019
Drilling Method: Hollow Stem Auger
Boring Location: MH#14L

Project Location: Huntsville, AL
Date Drilled: 10/18/10
Surface Elevation: 642

DEPTH (ft)	ELEVATION (ft)	SAMPLE TYPE	SAMPLE NO.	BLOWS PER INCREMENT	SOIL DESCRIPTION	GRAPHIC	REMARKS
0.0–3.0	642.0–639.0	Split Spoon	1	9-10-12	SANDY LEAN CLAY (CL): very stiff, dark yellowish-brown, with traces of sand size chert fragments and black nodules, dry		
3.0–15.0	639.0–627.0	Split Spoon	2	7-9-11	FAT CLAY (CH): very stiff, light yellowish-brown, with traces of sand size chert fragments, slightly moist		
		Split Spoon	3	8-7-10	with sand and gravel weathered chert fragments		
		Split Spoon	4	9-24-14	hard, light yellowish to reddish-brown		N-Value exaggerate by rock fragments
		Split Spoon	5	6-10-9	very stiff, yellowish-brown (RESIDUAL)		
15.0	627.0				Boring Terminated at 15 feet		No groundwater encountered at time of drilling Backfilled 10/15/10

N-Value (10, 20, 30, 40); Qu (tsf) (1, 2, 3, 4); Atterberg Limits (20, 40, 60, 80); % Moisture (20, 40, 60, 80)



SAMPLE TYPE: Split Spoon

N-VALUE	STANDARD PENETRATION RESISTANCE (AASHTO T-206)	**REC**	RECOVERY
% MOISTURE	PERCENT NATURAL MOISTURE CONTENT	**RQD**	ROCK QUALITY DESIGNATION
∇	GROUNDWATER LEVEL IN THE BOREHOLE	**UD**	UNDISTURBED
Qu	UNCONFINED COMPRESSIVE STRENGTH ESTIMATE FROM POCKET PENETROMETER TEST		

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Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

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